User Manual

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PROJECT IDENTITY

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Document history

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0.1	2014-11-21	First draft	MS	MB
0.2	2014-11-27	Updated base station section and Balrog section	MS	DÖ
0.3	2014-11-28	Updated according to comments from client	MS	MB
1.0	2014-12-04	Version 0.3 approved by client	MS	MB
1.1	2014-12-05	System setup chapter added	DÖ	MB
1.2	2014-12-09	System setup reviewed according to comments	DÖ	MS

1 Introduction

This document describes how to handle and maintain the Balrog system and its surrounding components.

1.1 System description

The system consists of three parts:

- Balrog
- Base station
- Handcontroller

Balrog is the robot that autonomously searches and maps the selected search area. The base station is the operating hub from which Balrog can be manoeuvred and where the map is displayed. The handcontroller can be used to steer Balrog when Balrog is in manual mode. The following sections describe how to use the different subsystems.

2 System setup

This section desribes how to get up and running with Balrog from scratch

2.1 Hardware

Make sure all hardware is connected to the Balrog. The GPS, IMU, ARM, laser scanner and handcontroller receiver must be connected via USB. An Ethernet cable from one of the LAN ports on the router must be connected to the left ethernet jack on Balrog. In addition to this the Balrog main computer power supply must be connected, please see Figure 1.

It's recommended to connect the ARM-controller to the non USB 3 ports as it is not fully compatible with USB 3.

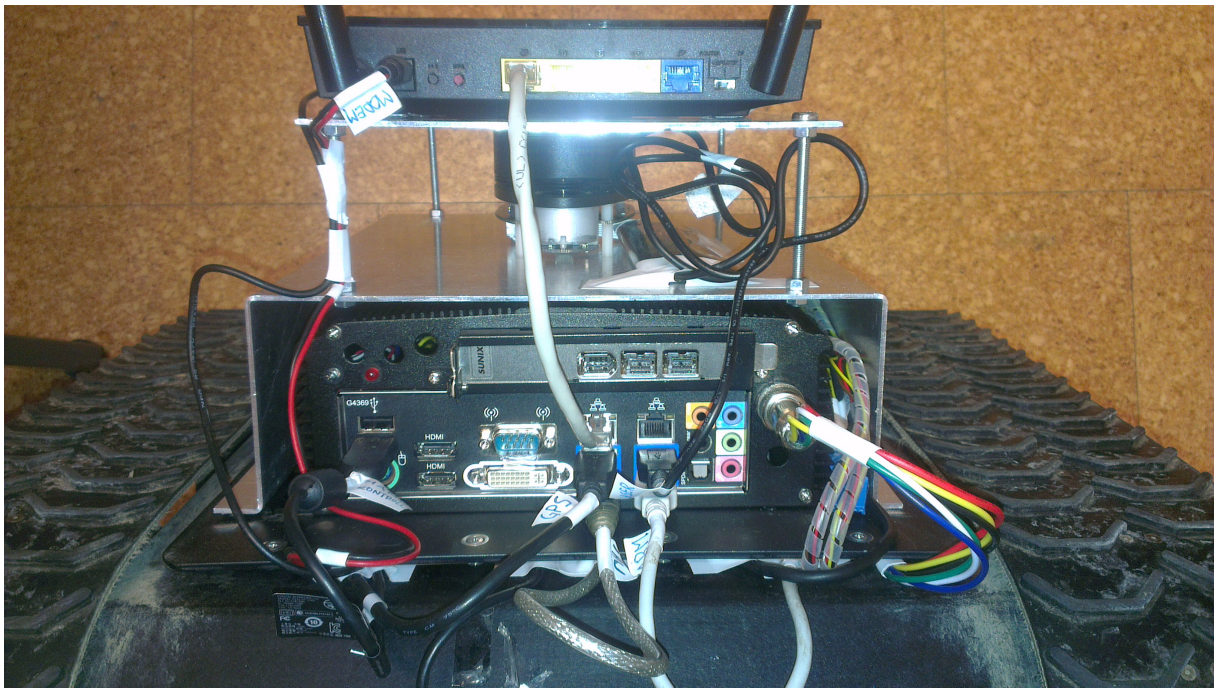

Figure 1: Correct setup of cables and wires

2.2 Software

Both the basestation and Balrog unit runs Ubuntu 14.04.4 with the following dependencies installed. To install external dependencies from a terminal, run the following command

```
sudo apt-get install git build-essential autoconf cmake \
qt4-qmake qt5-qmake qt4-dev-tools
```

In addition to this all USB-device rules has to be set up, which can be done via the following commands

```
cd SOURCE_DIR/os
sudo ./installConfigs.sh
```

Assuming the current directory is `SOURCE_DIR` the external libraries can be compiled by running

```
cd SOURCE_DIR/vendor && ./build.sh
```

The software can then be compiled via

```
cd SOURCE_DIR && ./buildall.sh
```

which will produce executables of basestation (`SOURCE_DIR/basestation/bin/basestation` and app_balrog (`SOURCE_DIR/app_balrog/bin/app_balrog`.

3 Base station

The base station is used to control and monitor Balrog. This can be done either through a terminal or through a GUI. For more information on how to monitor Balrog through the terminal, see section 5.

3.1 GUI

To start the GUI, run the `basestation` project on the laptop while being connected to Balrog's Wifi. To run the project, use the terminal and run the `basestation` file located in `basestation/bin` or run it through Qt-creator. Once the program has started, it will ask the user for Balrog's IP, which is 192.168.1.3 when connecting through Wifi. Enter the IP and press 'Connect'.

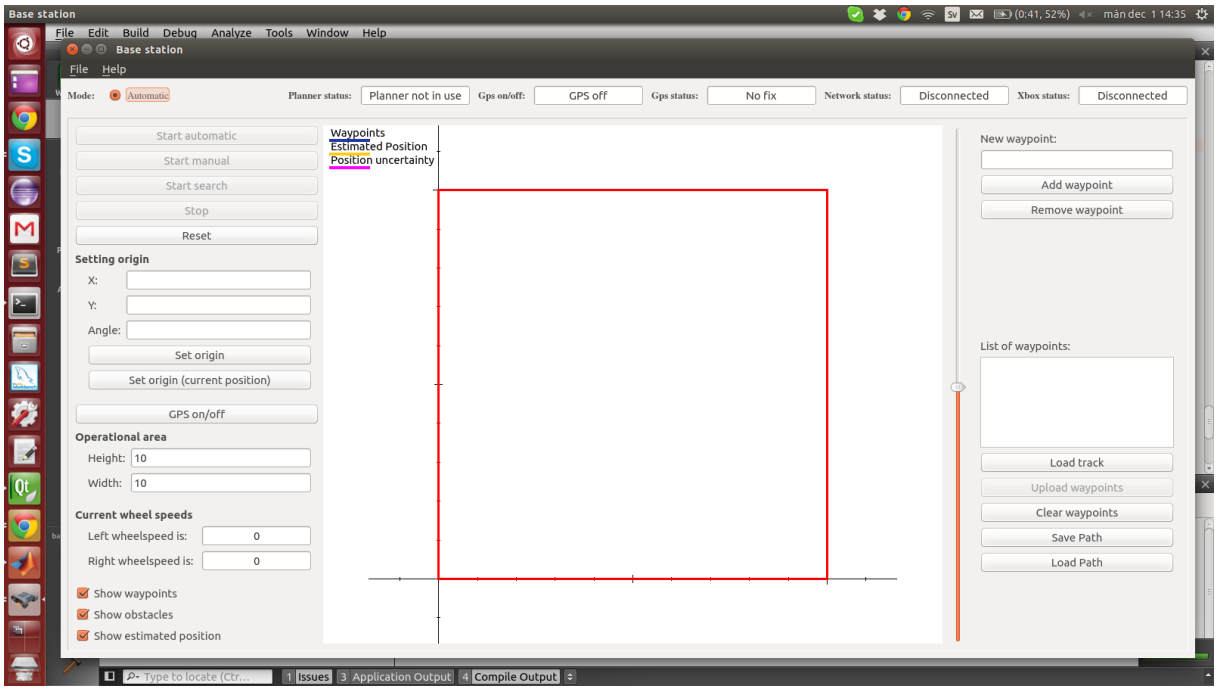

Figure 2: Basestation GUI

Balrog can then be controlled by using the arrow keys for direction and w and s -keys for speed when in manual mode.

4 Hand Controller

The hand controller, which is an unmodified XBOX controller, is used to manually maneuver Balrog.

Figure 3: Hand controller

The button labeled as 1 in figure 3 is used to start the handcontroller and initiate connection to Balrog. This button must be pressed before starting the main program on Balrog (`app_balrog`) to ensure connection between hand controller and Balrog.

The joystick labeled as 2 in figure 3 is used to manouver Balrog once connected. It steers Balrog relative to Balrog's current position, e.g by pushing to joystick forward Balrog will keep a straight course and move forward.

The hand controller will turn off automatically after a certain time if it does not find or looses the connection.

5 Balrog

This section describes how to start and connect to Balrog, how to shut down and how to power off Balrog.

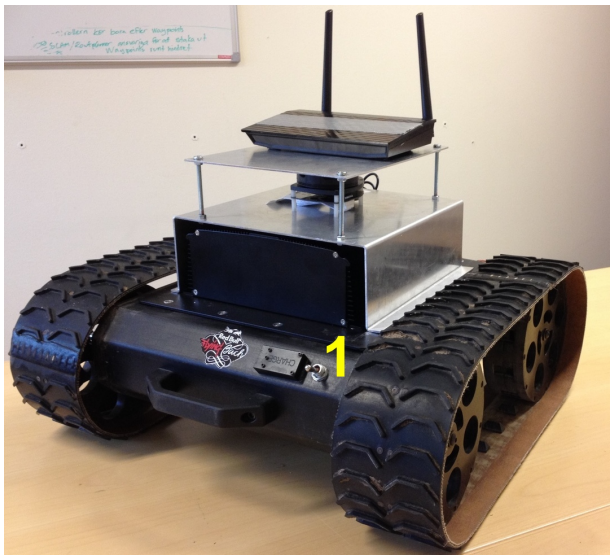

Figure 4: Balrog

5.1 Connecting to Balrog

To start up Balrog, flip the main switch labeled as 1 in figure 4. After a couple of seconds you will be able to access the WiFi network `Balrog` using the password `bandvagn`. Once connected to the network, open a terminal (Linux or Mac) and run `ssh balrog@192.168.1.3`. You will then be prompted for Balrog's password, which is `balrog3000`.

It is also possible to connect to Balrog using an ethernet cable. This is done by connecting a cable to the unused network card on your computer and manually changing your IP address to something in the same subnet as Balrog, i.e change to `192.168.0.1`. Balrog will then be reachable by running `ssh balrog@192.168.0.2` and writing `balrog3000` as password. `192.168.0.1` is also set to Balrog's default gateway on that interface thus you can route Internet traffic from Balrog through your own computer.

5.2 Starting Balrog's through the terminal and logging data

Once connected to Balrog, the main program is started by navigating to `app_balrog/bin` and running `./app_balrog`. This will start the main program and allow for example manual control through the base station and hand controller if the hand controller is connected. To log data from the sensors while the program is running, navigate to `app_balrog/bin` and run `./app_balrog -debug`. This will log data continuously from all sensors, as well as states and input signals to the motors, until the application is terminated by pressing `ctrl + c`. The log files are stored in the folder where the program is started.

One way to retrieve the log files from Balrog is by mounting Balrog to the laptop (or any computer). This can be done by navigating to `scripts/host` and running `./mount.sh` on the laptop while being connected with ethernet cable to Balrog. This will mount Balrog as a disc on the laptop and allow for file transfers. To unmount Balrog, run the script `./unmount.sh`, which is located in the same folder.

5.3 Shut down Balrog

To shut down Balrog you must be connected to Balrog. When connected, running `sudo shutdown -h now` in Balrog's terminal will terminate Balrog's computer. Thereafter it is safe to flip the main switch to turn off the power supply. If not done this way there will appear a prompt next boot that the computer didn't stop correctly and if you want to review the BIOS/UEFI settings.

5.4 Charging Balrog's battery

The charger is inserted into the charge connector next to the main switch. While charging the battery on Balrog, the main switch must be in off-mode (pointing downwards).

5.5 Update software on Balrog

To access and download new code to Balrog, Balrog must be connected to the Internet. Connecting Balrog to the Internet can be done by connecting the laptop to Balrog by

ethernet cable and running the script `sudo ./nat.sh` in the `os`-folder on the laptop. The `nat.sh` script shares the Internet connection from the laptop to Balrog. Once connected, the new code can be downloaded to Balrog (for example by using Git, see github.com for instructions on how to use Git).